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Role of Natural products from *Mangifera indica* Linn

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ABSTRACT

Since ancient times, plants have been an exemplary source of medicine. *Ayurveda* and other Indian literature mention the use of plants in treatment of various human ailments. India has about 45,000 plant species and among them, several thousands have been claimed to possess medicinal properties. Medicinal plants are potential source of novel compounds and traditionally used in treatment of various diseases. Different pharmacological activities of *Mangifera indica Linn* and their products have been demonstrated and also identified the medicinally important phyto-constitutents. A number of biological constituents in good yield and some have been shown to possess useful biological actions belonging mainly to polyphenols, tannins, and flavonoids. The main pharmacological activity of *Mangifera indica* is antioxidant, anti-diabetic, anti-inflammatory and anti-microbial activities. This review deals with *Mangifera indica Linn* and their products (active, natural principles and crude extracts activity) that have been examined for antioxidant activity and various biological properties including anti-diabetic, anti-inflammatory, analgesic, immunomodulatory, antimicrobial and anti-diarrhoeal effects.

Keywords: *Mangifera indica* Linn, Chemical constituents, Anti-oxidant, Anti-diabetic effects

INTRODUCTION

Indian Medicinal plants and their derivatives are being traditionally used as therapeutic agents to treat various diseases. The involved cost and lack of infrastructure, prevailing in rural India gives a scope to incline to its traditional source of healthcare through Ayurved, particularly in the use of medicinal herbs and plants.

According to the studies on ethnomedicine and folk medicine about 2000 species are newly identified as drug yielding plants and are well known for their use in about 4000 drug industries of various Indian system of medicine [1].

Dietary antioxidants are believed to protect humans from disease and aging, since they play a major role in maintaining the homeostasis of the oxidative balance. Plant-derived phenols are reported to have a broad spectrum of free-radical scavenging, antioxidant and protective activities [2,3].

The present review highlights the antioxidant activity, anti-diabetic and other therapeutic activities of *Mangifera indica Linn.*

Mangifera indica L. (*Anacardiaceae*) grows in the tropical and subtropical region and its parts are commonly used in folk medicine for a wide variety of remedies [4]. Mangoes belong to the genus *Mangifera* which consists of about 30 species of tropical fruiting trees in the flowering plant family *Anacardiaceae*. The mango is native to Southern and Southeast Asia.

The origins of mango are thought to have been from a plant that grows in Malaysia, India and Indonesia [5]. The mango is now widely cultivated as a fruit tree in frost-free tropical and warmer subtropical climates throughout the Indian subcontinent, North, South and Central America, the Caribbean, South and Central Africa, Australia and Southeast Asia. Mango is rich in dietary fiber and carbohydrates [6]. It contains diverse essential vitamins and minerals.

The antioxidant vitamins A, C and E comprise 25%, 76% and 9%, respectively. Mango peel (fruit) and pulp contain other phytonutrients, such as carotenoids, polyphenols and omega-3 and -6 polyunsaturated fatty acid. Mango peel has considerable potential as an antioxidant food source [7, 8].

Antioxidants of the peel and pulp include numerous carotenoid and polyphenols such as quercetin, kaempferol, gallic acid, caffeic acid, catechins, tannins and the unique mango xanthone, mangiferin [9, 10, 11, 12]. The mango triterpene, lupeol is an effective inhibitor in laboratory models of prostate and skin cancers [13, 14, 15].

PHYTOCHEMICAL CONSTITUENTS FROM *MANGIFERA INDICA* LINN.

An extract of mango branch bark Vimang contained numerous polyphenols and showed significant antioxidant properties *in vitro* [16]. Mangiferin ($C_{19}H_{18}O_{11}$) was isolated from the leaves, heartwood

and stem-bark of *Mangifera indica* and reported that mangiferin was a stable C-glycoside of the xanthone group [17]. Extract obtained from the stem bark of selected varieties of *Mangifera indica* consisted of a defined mixture of components of polyphenols, terpenoids, steroids, fatty acids and microelements [18].

A new triterpenoid, 29-hydroxymangiferonic acid (3-oxo-29-hydroxycycloart-24E-en-26-oic acid) was isolated from stem-bark of *Mangifera indica* [19]. Reversed-phase high-performance liquid chromatography was used for the determination of the biologically active plant phenolic compounds mangiferin, likviritin and dihydroquercetin in rat plasma and urine. The limit detections were for plasma 0.2 µg/ml and for urine 0.5 µg/ml [20].

Mango peel was being considered as a by-product in mango processing industry. It was also being considered as a good source of nutraceutical and phytonutrients such as polyphenols, carotenoids and anthocyanins. These compounds present in the peel extract were having protective effects against the oxidative damage [21]. Two new triterpenoids, 25 (*R*)-3-oxo-24-methylene cycloartan-26-ol and *ψ*-taraxastanonol were isolated from the neutral fraction of the stem-bark of *Mangifera indica* [22].

STRUCTURE OF MANGIFERIN FROM *MANGIFERA INDICA* LINN

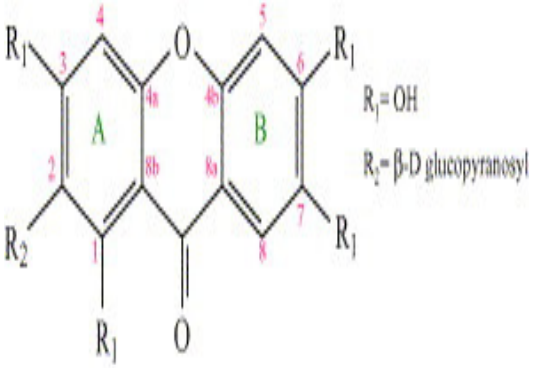

Table No: 1 Phytochemical compound isolated from *Mangifera indica* Linn.

ANTI-DIABETIC ACTIVITY OF *MANGIFERA INDICA* LINN

Oral administration of aqueous extract of the *Mangifera indica* leaves (1 gm/kg) failed to alter the blood glucose levels in normoglycemic or STZ induced diabetic rats. However, the extract showed anti-diabetic activity when given 60 min before or concurrently with glucose and this action could be due to reduction in intestinal absorption of glucose [23]. Stem bark aqueous extract of *Mangifera indica Linn* showed anti-diabetic, anti-inflammatory and analgesic activities due to presence of different chemical constituents, especially the polyphenolics, flavonoids, triterpenoids, mangiferin [24]. Intraperitoneal administration of mangiferin isolated from *Mangifera indica* partially ameliorated the glycosylated haemoglobin levels in a diabetic and exhibited potent antioxidant effects in diabetic animals [25].

IN VITRO AND *IN VIVO* ANTIOXIDANT ACTIVITY OF *MANGIFERA INDICA* LINN

Stem bark extract of *Mangifera indica* (MSBE) showed potent antioxidant effects both *in vitro* and *in vivo* [26-27]. Components of stem bark extract of *Mangifera indica* (MSBE) such as terpenoids, cathechin, fatty acids and microelements exhibited antioxidant properties [28-29]. Aqueous extract from the bark of selected species of *Mangifera indica* L. (Anacardiaceae) was used as a food supplement in Cuba, under the brand name of Vimang and it showed potent *in vitro* and *in vivo* antioxidant activities [30-31].

The activities of free radical-scavenging enzymes were elevated and lipid peroxide content was significantly decreased by oral administration of flavonoids from *Mangifera indica* and *Emblica officinalis* at a dose of 10 mg kg^{-1} body weight day^{-1} in hypercholesterolemic rats [32]. Vimang was used to prevent the production of reactive oxygen species (ROS) and the oxidative tissue damages *in vivo* [33].

In vivo preventive effects of a *Mangifera indica Linn* extract (Vimang) or its major component mangiferin on iron overload injury had been studied in rats. The report indicated that Vimang and mangiferin produced beneficial effects in iron overload related diseases [34].

IN VITRO AND *IN VIVO* ANTI-INFLAMMATORY ACTIVITY OF *MANGIFERA INDICA* LINN

Aqueous stem bark extract of *Mangifera indica* (MSBE) showed analgesic and anti-inflammatory effects and this extract inhibited the abdominal constriction induced by acetic acid and formalin-induced licking in mice [35].

Aqueous extract of *Mangifera indica* was tested on arachidonic acid metabolite production and it showed anti-inflammatory activities in both *in-vitro* and *in-vivo* studies [36]. Anti-inflammatory, analgesic and

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immunomodulatory effects of *Mangifera indica* L. were reported by several experiments [37, 38].

Table No: 1 Biological compound isolated from *Mangifera indica Linn*

Plant	Part used	Chemical compounds	Reference
Mangifera indica Linn	leaves	Mangiferin(C-glycoside of the xanthone group)	[17]
Mangifera indica Linn	Stem bark	Polyphenols, terpenoids,	[18]
Mangifera indica Linn	Stem bark	Terpenoids (29-hydroxymangiferonic acid)	[19]

EFFECT OF *MANGIFERA INDICA* LINN ON SMOOTH MUSCLES

Aqueous extract of the stem bark of *Mangifera indica* and ethanolic extract of the roots of *Pluchea ovalis* was studied on rat tracheal smooth muscle *in vitro* and it was observed that relaxation of the tracheal muscle strips and negated the contractile response of acetylcholine [39].Vimang and mangiferin inhibited NOS (nitric oxide synthase) and cyclooxygenase-2 expression in vascular smooth muscle cells [40].

IMMUNO-STIMULATION EFFECTS OF *MANGIFERA INDICA* LINN

Mangiferin (the main polyphenol of VIMANG, 10%) was tested *in vitro* and showed both immuno-stimulating and anti-viral properties [41]. Alcoholic extract of stem bark of *Mangifera indica* Linn (Extract I containing mangiferin 2.6%) was investigated for its effect on cell mediated and humoral components of the immune system in mice and it was concluded that test extract I was a promising drug with immunostimulant properties [42].

ANTI-BACTERIAL ACTIVITY OF *MANGIFERA INDICA* LINN

The antimicrobial properties of mango seed kernel ethanol extract (MKE) were investigated and reported that it had a broad antimicrobial spectrum. Further, it was more active against gram-positive than gram-negative bacteria [43].

Methanolic and aqueous extracts of seeds of *Mangifera indica* showed anti-bacterial activity and anti-diarrhoeal activity [44].

CYTOTOXIC EFFECT OF *MANGIFERA INDICA* LINN

The cytotoxic effects of Vimang (aqueous extract from stem bark of *Mangifera indica* L.) were studied on rat hepatocytes and reported that no cytotoxic effects were observed after 24 h exposure to Vimang [45].

Table2.Ethnopharmacological activities of *Mangifera indica* Linn

Plant	Part used	Activity	Reference
Mangifera indica Linn	Stem Bark	Antioxidant	[16]
Mangifera indica Linn	Stem bark	Antioxidant	[28,29]
Mangifera indica Linn	Stem bark	Antioxidant	[30]
Mangifera indica Linn	Stem bark	Analgesic, Anti-inflammatory	[35]
Mangifera indica Linn	Stem bark	Immunostimulant	[42]
Mangifera indica Linn	Seed	Anti-microbial, Anti-diarrhoeal, Anti-bacterial	[43, 44]
Mangifera indica Linn	Stem bark	Analgesic,Anti-inflammatory.Immunomodulatory	[45]

CONCLUSION

Traditional herbal medicines are an important part of the healthcare system of India. *Ayurveda*, supposed to be the oldest medical system in the world, provides potential leads to find active and therapeutically useful compounds from plants.

Currently there has been an increased interest globally to identify compounds that are pharmacologically potent and have low or no side effects for use in preventive medicine.

This review indicated that antioxidant, anti-diabetic, anti-inflammatory, immunomodulatory, antimicrobial, analgesic and anti-diarrhoeal and activities of *Mangifera indica* have proved by scientific validation.

Due to presence of different chemical constituents, especially the polyphenolics, flavonoids, triterpenoids, mangiferin and other chemical compounds present in the plant may be involved in the antioxidant, anti-diabetic, anti-inflammatory, immunomodulatory, antimicrobial, analgesic and anti-diarrhoeal and activities.

As our understanding of this review indicates that potential effectiveness of *Mangifera indica* needs further exploration because it is assumed that the *Mangifera indica* may have a major role to play in the management of various ailments.

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